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GEOLOGY AND PALEONTOLOGY.

On a New Species of Diplacodon, with a Discussion of the Relations of that Genus to Telmatotherium.—The material forming the basis of this paper consists of a skull with lower jaw (No. 11242, Princ. Collection) found by the writer near the base of the *Diplacodon elatus beds* of Osborn, in the upper Eocene or *Uinta*, of Marsh. The locality is about eight miles north of White River and twenty-five miles east of Ouray Agency, Utah, and is locally known as Kennedy's Hole. Other remains of Diplacodon were found, some of which are of considerable interest, inasmuch as they establish a lower geological range for that genus than has hitherto been accorded it, and indicate a considerable variety of species. Remains of Diplacodon are among the rarest of all the Uinta mammals, and any material which will increase our knowledge of this morphologically interesting genus is most acceptable.

In referring this skull to Diplacodon, I have been compelled to ignore certain characters ascribed to that genus by Prof. Marsh. That author, in speaking of the relations of this genus to the Titanotheriidæ (Brontotheridæ), in his original description of the type specimen, says:[1] "From this family Diplacodon differs widely in its dentition and the absence of horns." In describing Diplacodon as hornless, it would seem that Prof. Marsh's conclusion is entirely conjectural, since his material does not show whether there were horns or not. The present skull has a well-developed pair of frontonasal horns, and, since it agrees in all the characters *known* to that genus, I have preferred to refer it to that genus rather than to propose for it a new one on the strength of this purely conjectural character ascribed to Diplacodon by Prof. Marsh. Should future discoveries show that there are hornless forms with the same dental characters as Diplacodon, it will then be necessary to establish for the present specimen a new genus which may be called *Protitanotherium.*

Diplacodon emarginatus sp. nov.

The type of the present species is the skull and lower jaw above referred to (11242). The posterior region had already weathered out when found and was badly injured, but many of the pieces have been fitted together and show some of the more important characters of this region of the skull. Anteriorly both the skull and lower jaw are well preserved, and supplement admirably Prof. Marsh's type of this genus which consists only of the palate and premolar and molar teeth.

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[1] Am. Journ. Sci. & Arts, March, 1875, p. 247.

The present species is at once distinguished from *D. elatus* by its greater size, as is shown by a comparison of the length of the premolar and molar series, which is 310 mm. in the former and 242 in the latter.

The Cranium:—In general appearance the cranium of *D. emarginatus* is remarkably like some of the smaller forms of Titanotherium. The dorsal surface is slightly concave antero-posteriorly? and is further characterized by the absence of a sagittal crest. The nasal openings are high and deeply incised. The horns are composed of both the frontals and nasals; they are placed transversely and directed upward, outward and forward; they are elliptical in cross-section with the antero-posterior diameter the longer. The nasals are broad, strong and rather short, they are firmly coössified, concave inferiorly, emarginate anteriorly and with their external lateral borders considerably thickened, they do not extend as far forward as the premaxillaries and are slightly constricted just in front of the base of the horns. The premaxillaries are well-developed, are separated anteriorly by a deep median notch back of which they are firmly coössified, they extend considerably in front of the maxillaries. The maxillaries are expanded at the base of the canines and decidedly constricted between this tooth and pm. 2, back of which they expand rapidly in order to accommodate the large posterior premolars and molars. The infraorbital foramen is situated just above pm. 4.

The Lower Jaw:—The rami are closely united at the symphysis which is very long and oblique, its posterior border is just below pm. $_{\overline{3}}$. The anterior mental foramen is situated directly below pm. $_{\overline{2}}$, between it and the premolars there is a slightly excavated and fluted area. The rami gradually deepen from before backwards.

The Superior Dentition:—The superior incisors are placed considerably forward of the canines, and are arranged in the arc of a circle instead of in a nearly straight line as in Titanotherium; they show a remarkable transition from the Paleosyops to the Titanotherium type of incisor. The external, lateral incisors are large, pointed teeth, with strong, internal basal cingula and rather sharp external, lateral cutting edges. The median incisors are much smaller than those just described, but are larger and better developed teeth than the internal lateral incisors which are assuming the rudimentary, spherical form seen in Titanotherium. Both the median incisors and the internal laterals have posterior, basal cingula and a posterior ridge connecting the apices of these teeth with the cingula. The different degrees of development noticed in the superior incisors would seem to indicate the order of disappearance of these teeth in the Titanotheridæ. The superior canines are large, pointed, conical teeth, nearly circular in cross-section ; they are directed almost straight downward, only slightly forward, and scarcely any if at all outward. There is a diastema between the superior canines and pm. 1, which is a very simple tooth fixed in the jaw by two roots, and consisting of a single cone with a posterior heel. The remaining superior premolars and molars are wanting in the present specimen.

The Inferior Dentition :—Of the inferior incisors the median ones are much the larger, while the external and internal laterals are about equal in size; they all have internal basal cingula. The crowns of these teeth are somewhat wedge-shaped, with an anterior and a posterior inclined plane. The inferior canines are very much like the superior, and are directed upward, outward and forward; they are separated from premolar one by a considerable diastema. The latter is a very simple tooth, consisting of a single median cone with anterior and posterior ridges. In the present specimen pm.$_{1}$ on the right side is a much smaller tooth than the one on the left. Pms. $_{2}$, $_{3}$, are becoming molariform, and pm. $_{4}$ has already assumed the molar pattern. The inferior molars are identical in character with the same teeth in Titanotherium and need no further description ; m. $_{3}$ in the type specimen is injured.

The figures in Plate XXXVIII accompanying this paper, were drawn by Mr. Rudolph Weber, and represent accurately the more important characters of the skull and lower jaw of the type specimen. Figs. 5 and 6 are introduced for comparison.

MEASUREMENTS :

The Cranium.

	mm.
Length of nasals from base of horns, ...	114
Breadth of nasals anteriorly, ... , . .	123
Breadth of nasals at point of greatest constriction in front of horns, ...	112
Distance between top of horns at middle of their apices, .	151
Transverse diameter of horns at a point midway between base and summit, ...	40
Antero-posterior diameter of horns at a point midway between base and summit, . , ...	66
Length of diastema, ...	27

The Lower Jaw.

Distance from front of symphisis to anterior border of ascending rami, ...	385
Depth of ramus below pm. $_{\overline{1}}$, ...	63
Depth of ramus below m. $_{\overline{2}}$, ...	110
Length of symphisis, ...	152
Length of diastema, ...	26
Distance from base of pm. $_{\overline{2}}$ to anterior mental foramen,	42

The Dentition.

Length of crowns of sup. internal, lateral incisors, . .	10
Length of crowns of sup. median incisors, . . .	13
Length of crowns of sup. external, lateral incisors, . .	21
Transverse diameter of sup. canine at base, . . .	26
Length of inf. premolar-molar dentitions, . . .	310
Length of inf. premolar dentition, ...	107
Length of inf. molar dentition, ...	203

The Phylogeny of Diplacodon.

Marsh,[2] Osborn[3] and Earle[4] have all agreed in considering *Diplacodon* as ancestral to *Titanotherium,* and the present material only emphasizes the correctness of their views. This is evidenced not only by the structure of the teeth which, as was first pointed out by Marsh, is intermediate between *Paleosyops* and *Titanotherium,* but also by the general appearance of the skull which is strikingly like that of the latter genus, as will be seen by referring to the figures in Plates XXXVIII and XXXIX. This likeness is shown in the great depth of the cranium above the premolars and molars, in the absence of a sagittal crest, presence, shape and position of the horns, breadth of nasals, etc.

Earle, in his very excellent memoir on Paleosyops just cited, has attempted to indicate the phylogenetic positions of the various genera and species of the earlier Titanotheres. In this paper he derives *Diplacodon* from *Telmatotherium.* Later, Osborn,[5] in describing two new and several little-known species of *Telmatotherium* from most excellent material secured by Mr. O. A. Peterson, chiefly from the Uinta beds of Utah, has considered *Telmatotherium cornutum* as directly ancestral to *Diplacodon.* He says, on page 72 of the article just cited, "*Telmatotherium cornutum* is in one of the direct ancestral lines leading to the Titanotheres." In a recent paper by Earle,[6] he suggests a polyphyletic origin of the genus *Titanotherium* as had already been intimated by Osborn. Earle, in this last paper, points out very clearly two distinct lines of species of *Paleosyops* and *Telmatotherium* which he considers persistent series and probable ancestors of *Diplacodon* and *Titanotherium.*

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[2] New Tertiary Mammals, Am. Jour. Sci. & Arts, March, 1875, p. 246–247.

[3] The Mammalia of the Uinta Formation. Trans. Amer. Phil. Soc., Vol. XVI, pp. 461–572.

[4] A Memoir upon the Genus Paleosyops Leidy, and its Allies. Jour. Acad. Nat. Sci. Phil., Vol. IX, pp. 267–388.

[5] Fossil Nammals of the Uinta Basin. Expedition of 1894. Bull. Amer. Mus. Natl. Hist., Vol. VII, pp. 71–105.

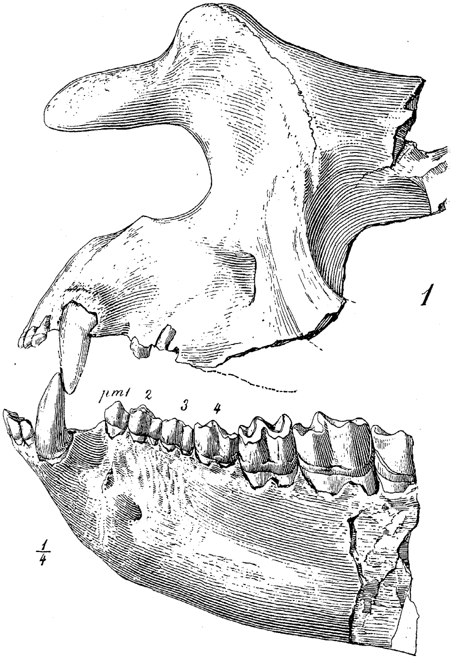
After studying *Diplacodon* in connection with what is already known of *Telmatotherium cornutum,* it seems impossible to accept Osborn's views in regard to the ancestral relations of the latter to any of the later Titanotheres. The *character* of the dentition and the presence of incipient frontonasal horns would, at first, seem to lead to such a conclusion, but a closer study of the material seems to indicate that this is simply a case of parallelism, since, in nearly every other character, *T. coruntum* exhibits features not at all in accordance with what we should expect to find in the immediate ancestors of the Titanotheres; as examples of such features, I would point out, 1, The long, narrow nasals; 2, Convex dorsal aspect of skull; 3, Position of posterior nares which, according to Osborn, are in this species moved backward until they now open far back behind the last molar; 4, The slender and almost parallel zygomata; 5, The presence of an infraorbital shelf; 6, The reduction in the number of inferior incisors to two on either side, while *Diplacodon* still retains three well-developed ones on a side; and Marsh[7] has shown that some of the later forms from near the base of the White River beds still retain three on a side, although quite rudimentary as would be expected. These are all characters of importance, and the position of the posterior nares and reduction of the number of incisors in *T. cornutum* would seem to absolutely prohibit the placing of that species in the direct line leading to the genera *Diplacodon* and *Titanotherium.*

There seems to be little doubt that *Diplacodon* had an earlier ancestry than has heretofore been referred to it, for remains of it are found in the *T. cornutum beds* of Osborn associated with remains of that

[6] On a Supposed Case of Parallelism in the Genus Paleosyops. Am. Nat., July, 1895, pp. 612-626.

[7] Notice of New Tertiary Mammals. Am. Journ. Sci., June, 1890, pp. 523-525.

PLATE XXXVIII.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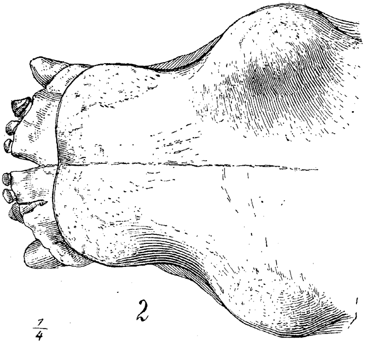
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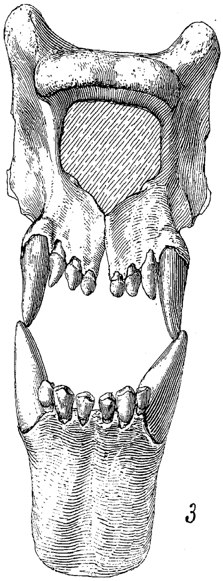
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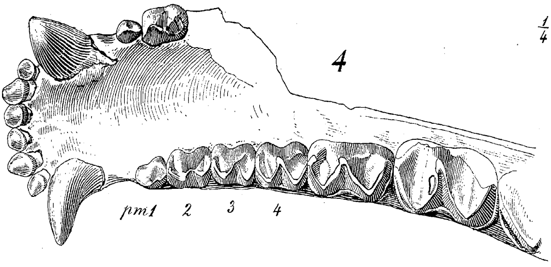
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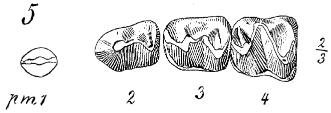
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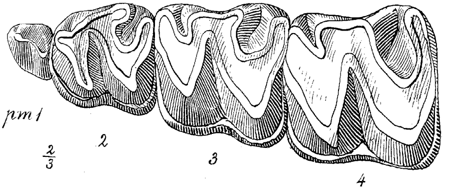
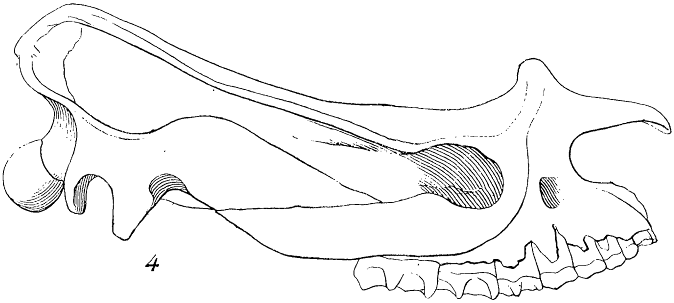

6

Hatcher on Diplacodon.

PLATE XXXIX.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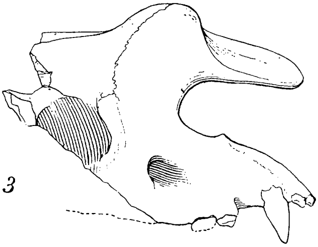
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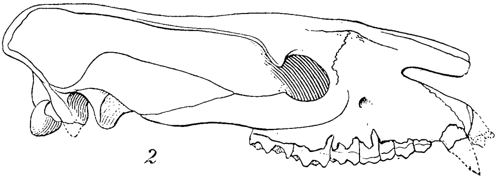
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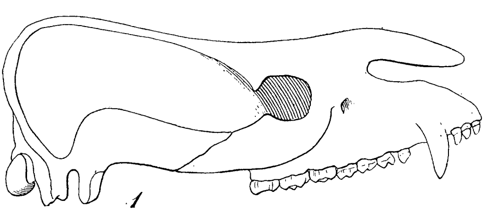
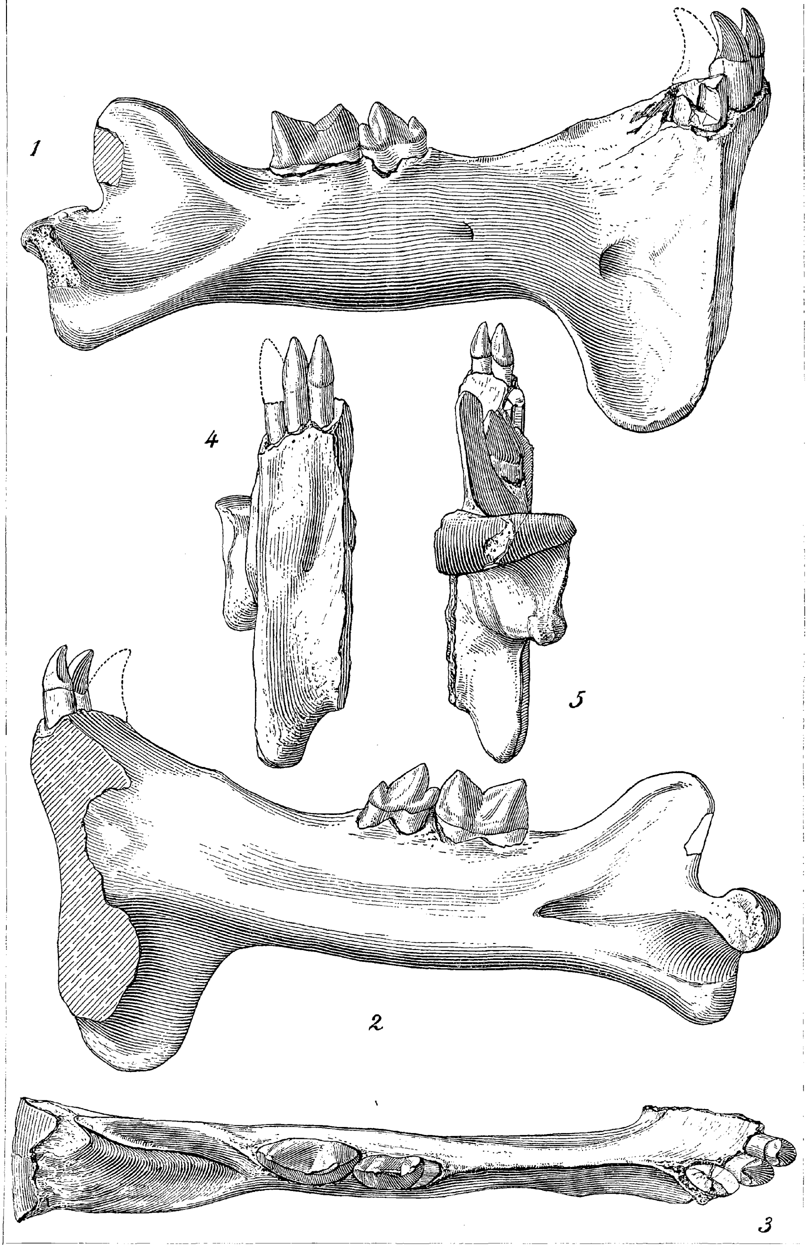

1

Hatcher on Diplacodon.



R. Weber, del.

EUSMILUS DAKOTENSIS, Hatcher.
⅔ nat. size.

species, and already at the base of the Uinta proper (*Diplacodon elatus beds* of Osborn) it exhibits a considerable variety of forms. Aside from the two species already known, there are indications of still others, one of which is shown in the pair of nasals (No. 11213) represented in the outline drawing, Fig. 1, with the same portion of *D. emarginatus*, Fig. 2, drawn to the same scale introduced for comparison. Notice the greater absolute and proportional breadth of the former, also the more pronounced medial emargination.

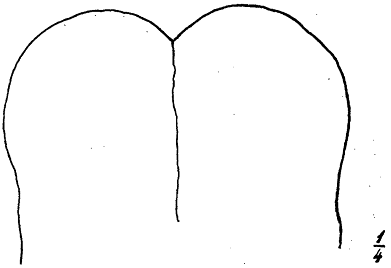


Fig. 1. Sup. view of nasals of *Diplacodon*, sp. ¼ nat. size.

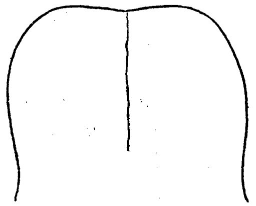


Fig. 2. Sup. view of nasals of *Diplacodon emarginatus*. ¼ nat. size.

If we compare *Diplacodon* with *Telmatotherium vallidens*, we shall meet with much more consistent results, for in this species we have all the conditions which we should expect to find in the ancestor of *Diplacodon* from the Washakie beds. In *T. vallidens* the sagittal crest is already disappearing, the anteroposterior dorsal aspect of the skull is slightly concave, the zygomata are expanding and becoming stronger, the nasals are becoming broader and shorter, there are incipient frontonasal horns, and there are none of those inconsistent characters so numerous in *T. cornutum*. The Bridger representative of this series was doubtless *Paleosyops laticeps*, which has the concave dorsal aspect of the skull, broad zygomata and short nasals, all characters indicative of *T. vallidens*.

In conclusion, there seems little doubt that the Parallel Series, I and II, established by Earle in his late paper, were differentiated early in the Bridger, and that Series I, of that author, was terminated in the Uinta, most likely by *T. cornutum*; while Series II was continued on up into the White River and terminated in the genus *Titanotherium*. Figures 1, 2, 3 and 4, Plate XXXIX, are introduced to show the successive stages of development from the Bridger to the base of the White River beds. Future discoveries will doubtless close the gaps between 2 and 3, and 3 and 4, but there would seem to be little doubt that the genus *Titanotherium* has been evolved from the earlier Bridger forms of *Paleosyops* through *P. laticeps* and the intermediate forms *Telmatotherium vallidens* from the Washakie and *Diplacodon* from the Uinta. Vertebrate paleontology rarely shows a more complete series of the stages of development than are to be seen here.

I wish here to thank Prof. Scott for his kindness in placing at my disposal the material upon which this paper is based. My thanks are also due to the various undergraduate and graduate members of the expedition of 1895, whose generosity alone made it possible.

EXPLANATION OF PLATES.

Plate XXXVIII.

Fig. 1.—Side view of front of skull of *Diplacodon emarginatus.*
Fig. 2.—Dorsal view of same.
Fig. 3.—Front view of same.
Fig. 4.—Crown view of lower jaw of same.
Fig. 5.—Crown view of inf. premolars of *Paleosyops laticeps.*
Fig. 6.—Crown view of inf. premolars of *Titanotherium* sp.

Plate XXXIX. All figures ¼ natural size.

Fig. 1.—Side view of *Paleosyops laticeps* (after Earle).
Fig. 2.—Side view of *Telmatotherium vallidens* (after Osborne).
Fig. 3.—Side view of *Diplacodon emarginatus.*
Fig. 4.—Side view of *Titanotherium varians* (after Marsh).

—J. B. HATCHER.

Princeton, N. J., Oct. 29, 1895.

POSTSCRIPT.

The genus *Telmatotherium* as it now stands should be divided, since it embraces at least three quite distinct forms. The type of *T. vallidens* should be removed from that genus and made the type of a new genus. This new genus may be called *Manteoceras* as suggested by Wortman from the field, it would be distinguished from *Telmatotherium* by the absence of the infraorbital shelf, the stronger and more expanded zygomata and the concave superior aspect of skull and incipient frontonasal horns. The type of *T. cornutum* should also be made the type of a new genus which may be called *Dolichorhinus*, it would be distinguished from *Manteoceras* and *Telmatotherium* by the reduced number of inferior incisors, presence of incipient horns, presence of infraorbital shelf and position of posterior nares.—J. B. HATCHER.

Discovery, in the Oligocene of South Dakota, of Eusmilus, a Genus of Sabre-toothed Cats New to North America.—In 1873, Filhol[8] described and figured under the name of *Machaerodus bidentatus,* portions of the mandibles and superior canines of a sabre-toothed cat from the phosphorites of Quercy. Two years later, Gervais[9] described similar remains from the same beds under the name of *Eusmilus perarmatus.* There seems to be little doubt that *E. perarmatus* is identical with *M. bidentatus;* but since the material shows characters which at once distinguish it from the genus Machærodus, Cope has accepted the genus Eusmilus, proposed by Gervais, and retained Filhol's specific name. *Eusmilus bidentatus* may then be considered to include all the known remains of this remarkable feline. Hitherto no American representative of this genus has been reported. In 1894 the writer had the good fortune to discover in the *Protoceras beds* of the upper *White River* (*Oligocene*) deposits a complete ramus which agrees fully in all the generic characters known to *Eusmilus,* and is of interest as being the first American representative of that genus. It differs, however, from the European species in several important characters, and may be called *E. dakotensis.*

Eusmilus dakotensis sp. nov.

The type of *Eusmilus dakotensis* consists of a right ramus (No. 11079, Princ. Coll.). It is in a splendid state of preservation, and all the teeth except the canine are entire. Most of the characters are well shown in plate XL, accompanying this paper, which has been produced from very accurate drawings of the specimen made and placed at my disposal through the kindness of Mr. Rudolph Weber.

Dentition :—I $_{\overline{2}}$, C. $_{\overline{1}}$, Pm. $_{\overline{1}}$, M. $_{\overline{1}}$. The incisors are recurved, about equal in size, and have rather sharp lateral edges. The crown of the canine is gone, but the root of this tooth indicates that it was rather weak, the antero-posterior diameter is about twice the transverse. The alveolar border between the canine and pm. $_{\overline{4}}$ consists of a sharp ridge of bone; it is complete, and demonstrates conclusively the absence of pms. $_{\overline{1}}$, $_{\overline{2}}$, $_{\overline{3}}$. Premolar $_{\overline{4}}$ is well-developed and fixed in the jaw by two roots; it is directed upward and backward. The protoconid is high and sharp, the paraconid and metaconid are much smaller and about equal in size, the former has a somewhat internal position and is out of line with the other two cusps. There is only a faint indication of a basal cingulum. The sectorial is quite simple, consisting only of a protoconid and paraconid. The slight prominence on the posterior edge of the protoconid seen in Figs. 1 and 2, is due to wear by the opposing superior tooth. The protoconid is larger than the paraconid.

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[8] Bull. Soc. Phys. et Nat. Toulouse, 1873, t. I, p. 205.

[9] Journal de Zoologie, 1875, t. XVIII, p. 419.

The Ramus:—The most striking feature of the jaw is the extreme downward projection of its anterior angle or flange, which is about equal to the depth of the jaw proper. The flange is deeply concave exteriorly, its lateral surface is separated from the anterior by a sharp ridge of bone. The mental foramen opens far down, almost on a line with the inferior border of the ramus. Near the middle of the jaw, and just in front of pm. $_{\overline{4}}$, there is a small foramen directed forward and upward. The exterior surface below the molars is convex longitudinally. The masseteric fossa is deep, and is not enclosed posteriorly. The posterior angle is very strong, it is but slightly deflected, and is directed outward and backward. The condyle is low, being placed a little beneath the line of the alveolar border, it decreases in strength from within outward, and its articular surface describes accurately a reclining semi-cone. The coronoid process is strong, low and rounded. The inner side of the jaw is a nearly plane surface. The dental foramen is situated just back of the sectorial and a little below the middle of the jaw. The symphysis is very characteristic, it extends far down on the flange, and is greatly expanded superiorly and inferiorly, and much constricted medially. The chin was broad and *very* deep. About one-third the distance from the incisive alveolar border to the bottom of the anterior angle of the jaw there is a large foramen.

Eusmilus dakotensis is easily distinguished from *E. bidentatus*, 1, By its size, which is about two-fifths greater than that of the European species; 2, By the structure of the sectorial, which is without the posterior cusp seen in *bidentatus;* 3, By the structure of pm. $_{\overline{4}}$, in this tooth—in *E. bidentatus* the posterior cusp is much smaller than the anterior, while in *dakotensis* these cusps are about equal in size. Compare Figs. 141 and 142, Filhol's Phosphorites du Quercy, with Figs. 1 and 2 in the plate accompanying this paper.

The discovery of *Eusmilus* in the White River beds is additional evidence in favor of referring those deposits to the Oligocene as proposed by Cope and Scott.

MEASUREMENTS:

	mm.
Longitudinal diameter of m. $_{\overline{1}}$, ...	23
Transverse diameter of m. $_{\overline{1}}$, ...	10.5
Longitudinal diameter of pm. $_{\overline{4}}$, ...	16
Transverse diameter of pm. $_{\overline{4}}$, ...	8

Length of diastema,	54
Greatest length or ramus,	173
Distance from top of coronoid process to bottom of jaw,	56
Depth of jaw below sectorial,	33
Width of jaw below sectorial,	16
Distance from bottom of flange to incisive alveolar border,	89
Depth of symphisis,	71
Length of symphisis superiorly,	27
Length of symphisis inferiorly,	21
Length of symphisis medially,	10

—J. B. Hatcher.

Princeton, Nov. 1, 1895.

BOTANY.[1]

The Vienna Propositions.—In the January number of the *Oesterreichische Botanische Zeitschrift* Ascherson and Engler publish six propositions embodying their views upon nomenclature, accompanied by an explanation of the work of the international committee appointed by the Genoa Congress. The propositions themselves have been published quite extensively, but their explanation has not received much notice in this country. The explanation is of some interest to American botanists because it evidently furnished a part at least of the inspiration and even of the language of the recent "protest" of certain botanists against the Rochester Rules. It is also interesting as showing that the committee appointed by the Genoa Congress has practically dwindled down to Ascherson and Engler.

Following is a translation of the "explanation" and of the six propositions.

"Following the appearance of O. Kuntze's Revisio Generum Plantarum in the spring of 1891, a deep movement made itself visible among botanical systematists of all lands. In Germany it led to the inquiry set on foot by the Berlin botanists, in the course of which the four theses sent to over 700 colleagues were answered, for the most part favorably, by more than half of the addressees; by the Scandinavian

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[1] Edited by Prof. C. E. Bessey, University of Nebraska, Lincoln, Nebraska.